

# **NASA Glenn Safety Manual**

## **CHAPTER 14 - SHOP SAFETY**

**Revision Date: 12/99**

### **14.1 SCOPE**

This chapter sets forth the Glenn Research Center shop safety policy and assigns responsibilities for implementation and enforcement.

### **14.2 APPLICABILITY**

This chapter is applicable to the Cleveland and Plum Brook facilities, and any other facilities under the Glenn Research Center (GRC) cognizance.

### **14.3 POLICY**

GRC will provide the proper equipment, facilities, safety rules, and procedures necessary for safe working conditions. To achieve and maintain this safe working environment, the cooperation of every member of the staff is essential. The staff is responsible for using the equipment and facilities in a safe, approved manner and for suggesting improvements and/or modifications to them, thereby contributing to an effective shop safety program.

Safety regulations cannot cover every situation. If conditions are not covered in this chapter or if deviations from these procedures become necessary, the Glenn Safety Office (GSO) shall be consulted prior to any work being performed.

Safety equipment issued by NASA remains the property of the U.S. Government and must be returned on demand. Reimbursement from the employee for loss of equipment may be required at the discretion of the Government.

### **14.4 RESPONSIBILITIES**

#### **14.4.1 Area Safety Committees**

Although the Center Director, the Executive Safety Board, and the GSO are responsible for setting policies and procedures and for assisting in the implementation of such policies, it is the Area Safety Committees who are responsible within their assigned areas for ensuring implementation of the Occupational Safety and Health Act and other established instructions and procedures.

### **14.4.2 Supervisors**

Supervisors are responsible for enforcing safety rules and regulations. They shall maintain safe working conditions and shall immediately correct recognized unsafe conditions affecting personnel and facilities under their jurisdiction. Each supervisor must ensure that all personnel under his/her supervision are aware of the applicable safety procedures, building regulations, and the requirements of this Manual.

### **14.4.3 Employees**

Each employee, as a condition of employment, is responsible for following all safety rules, regulations, and practices. Employees who violate safety rules are subject to disciplinary action.

## **14.5 REQUIREMENTS**

### **14.5.1 Basic Shop Safety Rules**

- a. All employees must know and comply with safety rules and regulations governing required protection and conduct in the areas in which they work.
- b. All employees are expected and encouraged to ask questions to remove any doubt about the safe way to perform any job.
- c. No employee may make alterations or perform major repairs on any safety equipment unless specifically authorized by his/her supervisor.
- d. Machines and equipment shall be operated only by personnel specifically qualified to do so.
- e. All necessary precautions shall be taken so that tools and materials are not, by reason of location or use, a hazard to others.
- f. Spilled materials shall be cleaned up properly, promptly, and completely, whether liquid or solid. If immediate cleanup is not possible, the area must be barricaded to prevent accidents. Reaction to a spill shall be preplanned and incorporated into use procedures. The Environmental Management Office (EMO) is available to advise users on prevention methods.
- g. All tools and excess materials shall be removed and properly disposed of after a job is completed.
- h. All air- or electrically-driven machines or tools shall be completely stopped when (1) the machine is being inspected, (2) work is being discussed with others, (3) the equipment is left unattended (except for machines designed for unattended operation), or (4) accessories or parts are being changed. For repair or maintenance procedures, electrically-driven machines or tools shall be locked out/tagged out in accordance with Chapter 9 of the Glenn Safety Manual.
- i. No drum shall be pressurized without prior approval of the Area Supervisor, who shall be advised by the Glenn Safety Office about the specific system and its provisions for fail-safe protection against over-pressurization.

- j. Employees shall not attempt to lift heavy or bulky objects that are beyond their capability. Size up the load and get help if needed. Keep your back vertical and knees bent; lift with your leg muscles, keeping the load close to your body.
- k. Employees shall not carry sharp objects in their pockets or clothing.
- l. Employees shall use approved containers or devices for transporting material or equipment.
- m. Aisles and walkways should be marked and used at all times. Short cuts through roped off or working areas, across ditches, or over rough grounds are prohibited.
- n. Walking or working under work stands or under suspended loads shall be prohibited.
- o. Makeshift devices shall not be used instead of ladders for reaching heights.
- p. Employees must use both hands when climbing or descending ladders.
- q. Desk drawers, cabinet doors, and locker doors shall be kept closed when not in use.
- r. Employees shall walk up or down stairs one at a time, using the hand rail.
- s. Employees shall walk carefully and be alert at all times. Running is not permitted except to avoid dangers.
- t. Horseplay is prohibited.
- u. Every accident or near miss shall immediately be reported to the supervisor, whether or not anyone is injured. A supervisor should report an incident to the GSO to determine proper reporting procedures (see Chapter 21, Mishap Reporting and Accident Investigation).
- v. Do not remove, displace, damage, destroy, or carry off from any location in the plant any safety device, safeguard, notice, or warning furnished for use there.
- w. No employee shall interfere with any method or process adopted for the protection of any employee, including him/herself.
- x. Posted work areas may not be entered without proper authorization and an understanding of the special safety rules of the area.
- y. Do not block aisles, passageways, corridors, fire lanes, or fire and emergency equipment.
- z. When driving, observe all local traffic rules and regulations, obey displayed warnings, and defer to emergency vehicles and vehicles used for transporting dangerous materials. Speeding will not be tolerated (see Chapter 19, Vehicle and Pedestrian Safety).
- aa. Smoking is prohibited in all federal facilities, do not use flames in posted areas or in any area where flammable or explosive materials are being used, stored, or handled, whether posted or not.
- bb. No unauthorized person shall make electrical or mechanical repairs on Government-owned equipment.
- cc. All tools furnished to or owned by an employee are subject to inspections and approval by the GSO, to ensure that the design, condition, and construction allow the work to be performed safely.
- dd. Only authorized personnel shall move, rearrange, and repair office equipment.

### 14.5.2 Personal Safety

**General rules.** The following regulations are for your protection:

- a. Do not work if you are ill, since your condition may cause an accident and injury to yourself or others.
- b. Sleeping on the job is prohibited.
- c. The possession or use of alcoholic beverages on Government premises is prohibited; no person shall report for duty or perform duties while under the influence of intoxicants.
- d. The use of narcotics, tranquilizers, or barbiturates by Government personnel while at work is prohibited without the cognizance of the Office of Health Services.
- e. Wearing of protective gear, such as hand protection, foot protection, eye protection, head protection, and respirators, is mandatory in areas and operations where specified. A job hazards analysis must be completed to determine the proper type of personal protective equipment (PPE) to use (see Chapter 15).
- f. Clothing and footwear that is appropriate for the work to be performed shall be worn. Jewelry, loose sleeves, ties, lapels, cuffs, tags, or other loose objects shall not be worn near moving machinery. When employees with long hair work with rotating machinery, they shall wear suitable headgear that completely confines the hair. Safety shoes shall be worn where mechanical or manual work is done and where chemicals or other materials are stored or handled. Slippers, canvas shoes, sandals, and shoes with open toes or high heels shall not be worn in such locations.
- g. Contact lenses shall not be used. Prescription safety glasses must meet Federal specifications for safety.
- h. The use of volatile or flammable chemicals as a skin cleansing agent is prohibited.

**Protective footwear** - Designated safety shoes are to be worn in areas where the type of work performed could be hazardous to the unprotected feet of the worker.

Footwear that is defective to the extent that its ordinary use creates the possibility of foot injury shall not be worn. Defective is defined as, but not limited to, footwear that has loose, broken, or missing parts which could cause the person to slip, trip, fall, or be exposed to falling substances that would cause injury.

Personnel working in areas where there is a potential for exposure to flammable or explosive hazards shall not wear metal cleats or other spark-producing devices on their footwear.

The GSO will issue special footwear requirements for contractor personnel if necessary. It shall be the contractor's responsibility to furnish the special footwear to their personnel unless otherwise noted in the contract.

**Protective headwear** - It is the policy of GRC to minimize the requirements for protective headwear in buildings and/or processes by providing well-protected, overhead work platforms and equipment with special safety design features, guards, and protective devices.

In specific areas or operations where it is not practicable to eliminate the hazards of head injury, head protection will be required and so designated.

Hard hats (or helmets) are necessary protection where there are hazards of bumping one's head or having it struck, of contacting high voltage equipment, or of having harmful materials fall on the head. Hard hats help prevent serious injuries from all of these causes, and even if the hat dents or shatters, it still takes the force out of the blow. Hard hats offer protection in four ways: (1) the hard shell resists and reflects the blow; (2) the impact is distributed over a large area; (3) the hat suspension acts as a shock absorber; and (4) the hard hat saves the scalp, face, and neck from the results of overhead spills of acids, chemicals, or hot liquids.

Protective headwear may be of two types: helmets with a full brim, and helmets with no brim, but perhaps with a peak. Hats with full brims give protection to the face, temples, and sides of the head, whereas hats that are brimless work well in confined spaces. Both types of hard hats shall be equipped with a suspension consisting of an internal cradle (crown, straps, and sweatband). And both types of hard hats must be properly adjusted to the wearer's head. There should be at least 1-1/4 inches clearance between the top of the wearer's head and the inside shell of the hat.

There are three different classes of hard hats, according to ANSI Z89.1: Class A, for general service (2,200 volts); Class B, for high voltage protection (20,000 volts); and Class C, for limited service (0 volts).

During escorted tours, the Building Manager may waive the hard hat requirements for visitors and workers for the duration of the tour. For unescorted or transient visitors, the supervisor having cognizance over a hard-hat area is to provide the necessary hard hats.

**Responsibilities of the supervisor:** It is the responsibility of the unit supervisor to provide for and ensure that:

- a. Entrances to hazard areas are clearly posted with caution signs warning against the impact and penetration from falling and flying objects as described in OSHA 29 CFR 1910.135.
- b. Hard hats are worn by everyone in designated areas or for a designated operation
- c. A regular schedule of hard-hat inspections is established and maintained, and that any hard-hat suspension which has been subjected to an impact is removed from service.

- d. Hard-hat stations to store, clean, and sanitize hard hats are established and maintained, with locations at entrances to designated hazardous areas if possible.
- e. Temporary requirements are imposed for the wearing of hard hats for operations of an infrequent nature, such as working in the immediate vicinity of overhead construction or modification work, and entry into pits or unprotected areas.
- f. All workers are trained in the care and use of hard hats.

**Responsibilities of the Building Manager:** It is the responsibility of the Building Manager to

- a. Ensure that all elevated platform work areas (heights greater than 6 feet) are equipped with toe-boards, and that workbenches in such areas are equipped with backboards if it is possible for tools or material to fall to a lower level
- b. Prevent the storage or hanging of items on overhead platforms or handrails where such items could be dislodged and fall to a lower level

**Responsibilities of the Facilities and Test Engineering Division:** The Facilities and Test Engineering Division is responsible for assuring a ready supply of

- a. Hard hats
- b. Suspension replacement parts, such as crown straps, suspension harnesses, and headbands
- c. Accessories such as chin straps, nape straps, winter liners, and face shields
- d. Two-way sanitizer and deodorizer for use as a disinfectant
- e. Poly bags for the storage of hard hats

**Responsibilities of the user:** It is the responsibility of the user to ensure the care of the hard hat by adhering to the following:

- a. Keep the hard hat free from scratches and abrasives. Do not engrave initials on hard hats; this destroys the integrity of the shell.
- b. Ensure that hard hats are maintained in a clean condition at all times.
- c. Wipe dust, dirt, and moisture from hats, suspensions, and sweatbands before storing. (When the hats are supplied for general use at a specific location, sanitizing materials will be supplied at that location.)
- d. When the hard hat is not in use, place it in a poly bag and store it on a special rack or in the designated area. Do not store it in sunlight.
- e. Participate in regularly scheduled hard-hat inspections.
- f. Use the hard hat only as intended; do not drop, throw, or abuse it.

### 14.5.3 Safe Use of Tools and Equipment

Approved tooling and equipment shall be used at GRC.

Defective tooling or equipment must never be used. Such equipment must be reported immediately to the supervisor so that it can be repaired or replaced.

**General rules** - The following are requirements for safe use of tools and equipment:

- a. Installation, alterations, or repairs to or substitution of tooling and equipment is to be accomplished only by personnel authorized by the supervisor.
- b. No makeshift tools or short-cut methods may be used unless authorized by the Area Supervisor.
- c. All guards must be in place before a machine is started.
- d. Equipment subject to periodic inspection and/or test shall not be used until such inspection or test has been verified as accomplished for the current period.
- e. Safety switches or devices shall not be blocked, tampered with, or altered in any manner.
- f. Unauthorized use of wood-working, metal-working, and other powered tools and equipment is prohibited.
- g. No equipment or machine shall be used if it has been "tagged" out of service. Switches that are "tagged" frequently control machines on which people are making repairs, and their lives may be endangered should the machine be started. Methods for locking/tagging out equipment are discussed in Chapter 9.
- h. Equipment and tools assigned to buildings are to be kept in a designated storage place when not in use.
- i. Before any contaminated equipment or components may be shipped to outside vendors or to any shop for maintenance, repairs, or rework of any kind, a thorough inspection shall be made by the authorized industrial hygienist or health physicist, who will affix the proper decontamination certificate in accordance with the existing decontamination procedure.

**Hand tools** - Only tools that are in good condition shall be used in operations. They shall be properly cleaned after use, and cutting tools shall be kept sharp.

Do not carry tools in your pockets. They shall be carried in a tool kit or in hand in such a manner as to prevent injury by stabbing, dropping, pinching, and the like. Some rules for specific tools follow.

**Hammers:** Before using a hammer, check the head for a tight fit. If the hammer has a cracked head or a loose or cracked handle, return it to the tool crib for replacement. Hammers that have burrs, loose chips, or signs of mushrooming shall not be used.

**Wrenches:** Use the correct wrench for the job to be done. Pull rather than push on the handle of the wrench. Do not place extensions on wrench handles for more leverage; use the proper sized wrench.

**Knives:** Keep your hands and the knife handles clean, dry, and free of grease.

Do not place knives on shelves or table edges where they might fall; keep the blade in a sheath when the knife is not in use.

**Pliers:** Wear eye protection when using pliers to clip wire ends. Hold the wire and pliers so that the ends, when snipped, are directed towards the ground.

**Equipment.** Other types of equipment and the rules that apply are as follows:

- a. All blowers or exhaust equipment must be operating when work requiring their use is performed.
- b. Propellant and oxidizer equipment shall always be grounded prior to actual firing. It shall be the responsibility of the supervisor to ensure that all ground straps are in a good state of repair and that they are used properly and used only for the purpose intended.
- c. No material may be attached to, or suspended from, fire lines or sprinkler and deluge systems.
- d. All auxiliary lighting equipment brought into propellant-processing buildings for temporary use by operators or maintenance personnel shall be explosive-proof. Exceptions to this rule require specific approval from GSO.
- e. As part of the grounding program, consistent with 29 CFR 1910.304(b), all shop supervisors are required to have qualified personnel conduct a quarterly electrical inspection and operational check of all portable shop equipment.
- f. At GRC the preferred ladders shall be fiberglass, for the following reasons:  
(1) Ladders are generally used in close proximity to electrical equipment; thus it is necessary for the worker to be isolated from ground by a nonconductive material. (2) Fiberglass ladders are nearly maintenance free, requiring little or no manpower for inspection, repair, and refinishing.
- g. All hooks, slings, and other fittings shall be the correct size for the work to be done and shall have sufficient strength to safely sustain the loads imposed on them. If this cannot be adhered to, a waiver from GSO must be obtained.  
**NOTE:** All hooks shall be approved safety hooks rather than the open-throat type.
- h. Prior to using equipment, employees should visually inspect it for defects.
- i. Where socketing is done, it shall be done only with zinc (spelter) and only by the manufacturer of the wire rope.
- j. Where swaged or compressed fittings are used, they shall be applied only by the manufacturer.
- k. The hook on any lifting device shall not be painted since this restricts visual or dye penetration inspection.



**Torque wrenches.** This section applies when the tightness of a threaded fastener is specified as a torque value (such as inch-pounds or foot-pounds or metric units) on engineering drawings or in specific written instructions from the design engineer. Although the direct elongation (micrometer), angular turn-of-nut, and other methods of controlling the tension in a threaded fastener are also commonly referred to as "torquing," a torque value is specified only when a precision torque wrench is to be used.

In addition to torque values, the written instructions for which this section applies must contain the tightening sequence and specify either non-lubricated threads or the lubricant for the threads. The instructions must clearly define the conditions for which the torque values were selected. The importance of clarity is that a slight change in one of the conditions may markedly alter the torque-tension relationship and, hence, the tension produced by a given torque. In general, this torquing method utilizes a torque-tension relationship to produce a tension in the fastener, within a relatively narrow range, that makes an effective fastener without overstress. The design engineer will specify the proper lubricant if one is to be used (such as a specific anti-seizing compound that may be required to prevent galling of thread materials in high-temperature applications) and the torque value that applies when this compound is used.

**Policy:** It is Glenn policy that when torque values are specified in the applicable written instruction, a calibrated torque wrench shall be used to tighten the fastener. On defined critical assemblies, torque-calibrated impact or nut-runner wrenches shall not be substituted for a precision torque wrench.

Coating the mating surfaces of joints is not permitted. All joints are to be assembled uncoated, clean and dry, metal-to-metal (except nonmetallic gasket designs).

For aircraft equipment, torque values shall be those given in the technical orders for the specific aircraft. For equipment other than aircraft, the torque values shall be determined by a design engineer and indicated on the applicable written instruction (maintenance/assembly manual) or drawings. Torque value specifications are required for all critical fasteners, such as rotating couplings, pressure joints, and components subject to high speed or high load vibration, high temperature, or severe temperature variation. Questions concerning torque values for specific fasteners on specific joints shall be resolved by the appropriate design engineer before the fastener is torqued.

**Procedure :** Before torquing a fastener, verify (1) that components of both the fasteners and the joint are as specified; (2) that there is a specific statement about lubrication of the threads (i.e., either a lubricant is specified, or dry/non-lubricated threads are specified); and (3) that the components of the joint and the fastener are clean. (This means no coating on mating surfaces of the joint, no paint on face of nuts or bolt heads, no burrs, grit, or dirt on threads, etc. not just "as received.")

**CAUTION:** Torque values depend on

- a. Size, type, fit, and plating of threads

- b. Materials of the joined fastener and pieces
- c. Whether washers are to be used and, if so, whether they are hardened or plain
- d. Whether threads are to be dry or lubricated and, if lubricated, what lubrication is to be used
- e. Whether a nut or a bolt is to be used

During rundown of the fastener to the snug position, verify that the turning effort matches the specified fit. As an example, if a Class-2 fit (free running fit) is specified, the assembler should be able to easily finger-turn the fasteners during rundown.

Torque the fastener to the value indicated on the applicable written instruction. Check carefully that the torque units of the instruction match those of the wrench. The use of an adapter or extension on a torque wrench will result in a greater torque application than indicated by the dial or setting. Thus, when an adapter or extension is used, the torque reading or setting must be determined as follows:

- Torque reading or setting =
- Specified torque (actual) x
- Length of wrench / (Length of Effective + wrench + extension length)

**Rules:** When a tightening sequence is specified for a contiguous group of fasteners

- a. Torque the fasteners in that sequence at reduced torque (10 percent below specification). Follow that initial torquing sequence with a second at 5 percent below specification before administering the final torquing sequence at the specified level. Exercise care so as not to exceed the specified value.
- b. Do not attempt to use a torque wrench to tighten a fastener to a higher value than the maximum value shown on the torque wrench indicator or setting.
- c. Sockets must be fully installed on the nut or bolt. Maintaining a slight inload (force holding toward the fastener) on the tool will lessen the chances of damage to the fastener.
- d. Never jerk a torque wrench. Force must be applied slowly to obtain an accurate indication of the torque being applied to the fastener.
- e. Torque readings must be taken only while tightening the fastener. Do not over tighten and then loosen to the desired torque value.
- f. All torque wrenches must be calibrated by authorized personnel at least annually to compensate for wear. The wrenches shall be identified by serial number and tagged with the calibration date; they shall not be used after the void date shown on the wrench. In order to ensure that all wrenches are available for annual calibration, each one is to be returned to the tool crib at the end of each shift. Torque wrenches shall not be kept in tool boxes, supply cabinets, and such.
- g. Torque wrenches are precision tools; they must not be subjected to abuse or misuse. Recalibration is required if the wrench is dropped. (In general, dial or click types are not as durable as beam memory torque wrenches.)

- h. When the torque specification calls for use of a torque-calibrated impact or nut-runner wrench, care shall be taken to ensure the proper preparation of the air (clean, dry, well-controlled pressure, proper lubrication) before it enters the pneumatic tool.
- i. Inspection and/or verification of torquing of high-speed coupling fasteners and fasteners designated as critical shall be logged for the record.

**Portable lifting devices and hoists.** The safety rules and responsibilities that pertain to shop personnel in the use of portable or fixed lifting equipment, are specified in Chapter 20 of this Manual.

**Powered industrial trucks.** This section establishes minimum safety standards for the construction, use, operation, and maintenance of powered industrial trucks, but does not apply to vehicles intended primarily for earth moving or over-the-road hauling. All operators shall be trained as per OSHA 29 CFR 1910.178. The standard states that operators will be trained on the powered industrial truck that they use primarily on a regular basis.

**Requirements:** The following requirements apply to the equipment, modification, maintenance, and repair of industrial trucks powered by electric motors or internal combustion engines:

- a. Each truck or tractor, except motorized hand trucks, shall be equipped with a warning device, automatic or manual, to alert personnel that the vehicle is moving backward. In some cases, when there is danger to personnel, warning devices may be installed to operate when the truck is moving forward and backward. Such devices may be warning lights (rotating or flashing yellow) or warning sounds (bell or horn).
- b. Overhead protection Per ANSI/ASME B56.1, industrial trucks shall be equipped with a driver's overhead guard whenever industrial truck operations expose the operator to the danger of falling objects.
- c. Load backrest extension: If the load will present a potential hazard when the mast is in a position of rearward tilt, the industrial truck shall be equipped with a backrest extension.
- d. Fueling (such as gasoline and diesel fuel): Industrial trucks shall be refueled at locations specifically designed and designated for the purpose. All refueling shall be in accordance with the NFPA 30.
- e. Liquefied petroleum gas fuel Storage and handling of liquefied petroleum gas (LP gas) shall be in accordance with the standards of "Storage and Handling of Liquefied Petroleum Gases" (NFPA 58; ANSI Z106.1).
- f. Battery charging Battery charging shall take place in an area designated for that purpose. Facilities shall provide
  - Flushing (neutralizing spilled electrolyte) equipment
  - Fire protection
  - Adequate ventilation for dispersal of fumes from gassing batteries

- A posted sign reading, "Caution No Smoking or Open Flames"
- g. Portable fire extinguisher One portable fire extinguisher for use on Classes B and C fires shall be kept on each vehicle.
- h. Name plates: A name plate shall be placed and maintained in a legible condition. The name plate should include the name of the manufacturer, model, serial number, type, weight, operation and maintenance instructions, rated load capacity, and information about alterations, changes, and use of attachments.
- i. Type designations: Each truck shall meet the requirements to be designated as a specific type under the NFPA 505 system. The designations under this system are
  - D diesel
  - E electrical
  - G gasoline
  - LP liquefied petroleum gas
  - DS diesel powered truck with additional safeguards to the exhaust, fuel, and electrical systems
  - DY diesel powered truck with all the safeguards of a DS type and with temperature limitation features, but with no electrical equipment, including the ignition
  - ES electrically powered unit with additional safeguards to the electrical system to prevent emission of hazardous sparks and to limit surface temperatures
  - EE electrically powered units with all the requirements of E and ES units, but with the electric motors and all other electrical equipment completely enclosed
  - EX electrically powered units different from E, ES, and EE units in that the electrical fittings are designed and assembled so that the unit can be used in certain atmospheres containing flammable vapors or dust (NFPA 505)
  - GS gasoline powered unit with safeguards to the exhaust fuel and electrical system
- j. Markings: Since the use of proper equipment in potentially hazardous areas is essential for the safety and protection of employees and property, trucks approved for use in such areas must be clearly identified and approved by the cognizant Area Safety Committee. Durable markers indicating the type of truck (from the list previously defined) should be applied to each side of the vehicle in a visible but protected location (NFPA 505 and ANSI B56.2).
- k. Conversion from gasoline to LPG fuel: Vehicles approved for gasoline can be converted to LP without approval of the manufacturer, providing that the conversion does not affect safe operation of the vehicle and that it complies with the manufacturer's conversion instructions. LPG vehicles, however,

cannot be converted to gasoline fuel, and vehicle upgrading from type G to GS is not currently permitted.

- l. Modifications and additions: Any modification or addition that affects capacity and safe operation shall be performed by the manufacturer or with his written approval, or with approval of the Glenn Safety Office. The name plate must reflect the change.
- m. Maintenance practices: All replacement parts shall be equivalent to those used in the original design, insofar as safety is concerned. A scheduled preventive maintenance and inspection system shall be followed.

**General rules:** Only authorized and properly instructed employees shall operate powered industrial trucks; each of these employees must have a U.S. Government motor vehicle operator's identification card, or equivalent in the case of contractors, for the type of powered industrial vehicle being operated. In addition, the following rules and procedures apply:

- a. Industrial trucks shall be operated within rated capacity.
- b. Before an industrial truck is operated, the truck shall be verified to be properly equipped for the work and location.
- c. Faulty equipment shall not be operated. The operator shall check the equipment before use, and any defect shall be immediately reported to the supervisor.
- d. Repairs and adjustments shall not be made by the operator unless he/she is specifically authorized to do so.
- e. Reckless driving and horseplay shall not be permitted.
- f. Operators shall not allow anyone to stand or walk under elevated loads.
- g. Operators shall not reach through fork uprights for any purpose.
- h. When a forklift is used to elevate employees, a suitable platform, securely fastened to the forks, shall be provided; the platforms shall include standard personnel guardrails.
- i. Motors shall not be allowed to idle for a long period of time in enclosed or semi-enclosed areas.
- j. Fuel tanks shall not be filled while the motor is running.
- k. Any spillage shall be carefully washed away, and tank caps must be replaced before restarting the motor.
- l. All accidents shall be reported immediately to the supervisor.
- m. When batteries of electric forklifts are being charged, vent caps should be kept in place to avoid electrolyte spray. Care should be taken to ensure that vent caps are functioning.

For other information, contact GSO.

**Operating rules:** The following are rules applying to powered industrial vehicles:

- a. Speed limits of 5 mph inside and 15 mph outside the plant buildings, consistent with conditions, shall be observed.

- b. Operators shall keep forks as low as possible when moving them, with or without a load.
- c. Operators shall look in the direction of, and keep a clear view of, the path of travel.
- d. Operators carrying bulky loads that obstruct vision shall always drive in reverse.
- e. Operators moving long lengths of material shall be guided.
- f. Only industrial trucks with pneumatic tires shall be used outside of the buildings.
- g. Industrial trucks specified for road use shall be equipped with head lights, tail lights, stop lights, and a horn.
- h. Operators shall keep to the right, slow down at intersections, sound the horn at blind corners, and come to a complete stop at all plant stop signs.
- i. Passing other vehicles at intersections shall not be permitted.
- j. Operators shall proceed cautiously around corners and on wet, greasy, or rough surfaces.
- k. A distance of at least three truck lengths shall be maintained behind other vehicles or pedestrians.
- l. Operators shall watch for weak floors, inadequate dock plates, and if entering a movable vehicle, shall ascertain that it has been secured.
- m. Driving over loose objects shall be avoided.
- n. Railroad tracks shall be crossed diagonally whenever possible. Forklifts shall not be parked within 8 feet of the railroad tracks.
- o. Any loaded forklift being driven downgrade shall have the load in the rear; on an upgrade the load shall be in front. When descending a grade, the truck shall be kept under control so that it can be brought to an emergency stop. On all grades, the mast shall be tilted back and the forks raised as far as necessary to clear the road surface.
- p. Operators shall avoid making quick starts and sudden stops.
- q. The right-of-way shall be given to ambulances, fire trucks, and other vehicles in emergency situations.
- r. No one but the operator shall ride on industrial trucks during transit. They are built only for one rider the operator. It is unsafe for anyone to hitch a ride in any manner.
- s. Operators shall keep clear of loading dock edges and watch all clearances and rear-end swing.
- t. No forklift shall be driven onto an elevator without specific authorization. Capacity of the elevator shall not be exceeded.
- u. No forklift shall be parked so as to obstruct aisles, pedestrian zones, fire equipment, electric panel boards, or stairways.
- v. A forklift shall not be left unattended without first lowering the fork to the floor, turning off the engine, setting the hand brake, and placing it in gear.
- w. A forklift shall not be left on an incline unless the brake is set and the wheels properly chocked.
- x. The hoist limit stop shall not be used to stop the hoist.

Loading and unloading procedures: The following rules apply to forklifts:

- a. Operators shall handle only loads that are properly stacked, secured, and/or palletized.
- b. Operators shall spread forks to accommodate load width and always place them as far as possible under the load.
- c. The load shall be kept centered and against the carriage, with the mast tilted back to cradle the load.
- d. Heavy loads shall be lowered or stopped gradually.
- e. Loads shall not be raised or lowered while the vehicle is in motion.

Rules for propane (LP gas) powered trucks: Since propane is a liquefied petroleum gas, ignition of gas that has escaped from improperly maintained fuel connections or that has been released by relief valves on fuel tanks are the greatest potential dangers. Therefore, the following rules must be observed:

- a. When replacing LP fuel tanks, shut off the tank valve prior to removal and operate the engine until all fuel in the system is consumed. Exercise care in making connections and make sure there are no leaks.
- b. When the truck is not in use, shut off the tank valve and store the vehicle in a designated parking area.

#### **14.5.4 Safe Use of Potentially Hazardous Materials**

**Transporting materials.** The following are rules for transporting potentially hazardous materials:

- a. Intracenter and intercenter shipment of materials, whether inert or potentially hazardous, shall require a properly processed Shipping Request.
- b. Employees shall not use the inter-laboratory mail or the United States mail to move potentially hazardous material (explosive, flammable, or toxic).
- c. When an employee must hand-carry potentially hazardous material in or between buildings, the material shall be taken in approved containers directly, without delay, to the destination.
- d. An employee shall not leave the Center carrying any potentially hazardous material on his person or in a suitcase, briefcase, or other luggage.
- e. Transporting potentially hazardous materials by private or Government automobiles, or in the cabs of Government vehicles, is prohibited unless the Safety Officer specifically approves and the material is in approved containers.
- f. Labels shall not be removed from chemical containers.
- g. Containers that have housed poisonous or hazardous chemicals shall not be used for transporting other materials.

**Spraying of paint or combustible liquids**. All spraying of parts or material shall be done in the approved ventilated spray booth or hood. In addition, the following rules apply:

- a. Spray booths and other locations regularly used for spraying paint or combustible liquids shall be ventilated to remove combustible or toxic vapors and to prevent accumulation of explosive or flammable mixtures in the air (29 CFR 1910.107(b)(5)(i) or NFPA 33).
- b. The power ventilation system shall be in operation at all times when paint or combustible liquids are being sprayed and for a reasonable time thereafter to ensure evacuation of all vapors.
- c. Electrical equipment used in conjunction with spray booths shall conform to the "National Electric Code," Class 1, Group D (NFPA 70) and shall be located where not subject to deposits of combustible residues.
- d. All electrical equipment used within 20 feet of the opening of the spray booth shall comply with the state code and the "National Electric Code" Class 1, Group D, Division 2, for outside booth use, or Class 1, Group D.1, for inside booth use.
- e. Spray booths shall be equipped with a National Fire Protection Agency-approved sprinkler system per 29 CFR 1910.107. paragraphs (c)(6)(i) and (h)(12).
- f. Anytime that extensive spraying outside of a spray booth becomes necessary, such work shall be done when the area is clear of all employees not engaged in the spraying operation.
- g. Areas in and around spray booths and hoods shall be kept free of combustible deposits on floors, walls, and ceilings.
- h. Smoking shall not be permitted in any area where spray painting is done.
- i. Only authorized personnel shall be in the spray booth during spray painting.
- j. All personnel shall wear industrial hygienist-approved respirators when spray painting and be participants in the Respiratory Protection Program.
- k. All equipment in the spray booth that may generate static electricity shall be grounded.
- l. No source of ignition shall be permitted in any area where combustible materials are being sprayed.
- m. Before any repair to the spray booth is undertaken involving the use of torches, electric arcs, or other sources of ignition, approval shall be obtained from GSO and Area Safety Committee chairman.
- n. Employees shall not use any solvent for the purpose of cleaning hands or arms unless approval is obtained from the Office of Health Services.
- o. Since highly toxic paints are generally applied under controlled conditions, special precautions shall be taken, and strict adherence to safety practices specified by the manufacturer shall be required.
- p. All paints in the toxic category shall be treated as extremely poisonous and flammable.



- q. Personnel shall wear air-line respirators when they are spraying in confined spaces or within a building. This requires strict adherence to the safety practices specified by the manufacturer.
- r. Spraying shall be done only in approved areas where adequate fire extinguishing equipment is immediately available.
- s. All skin area shall be covered with adequate clothing or protective equipment.
- t. Contaminated clothing shall not be worn.
- u. Employees shall wash thoroughly before eating or smoking.

## 14.7 BIBLIOGRAPHY

- ANSI B56.12. American National Standards Institute. 1975. Industrial Trucks.
- ANSI Z89.1. American National Standards Institute. 1968. Industrial Workers, Protective Headwear for.
- ANSI Z106.1. American National Standards Institute. 1974. Storage and Handling of Liquefied Petroleum Gases.
- ANSI/ASME B56.1. American National Standards Institute/American Society of Mechanical Engineers. 1988. Low Lift and High Lift Trucks.
- ANSI/CGA Std. American National Standards Institute/Compressed Gas Association. 1987. Compressed Gas Cylinder Valve Outlet and Inlet Connections.
- NFPA 30. National Fire Protection Association. 1990. Flammable and Combustible Liquids Code.
- NFPA 33. National Fire Protection Association. 1989. Spray Application Using Flammable and Combustible Materials.
- NFPA 58. National Fire Protection Association. 1989. Standard for the Storage and Handling of Liquefied Petroleum Gases.
- NFPA 70. National Fire Protection Association. 1990. National Electric Code.
- NFPA 505. National Fire Protection Association. 1987. Fire Safety Standard for Powered Industrial Trucks.
- Public Law 91 596. 1970. Occupational Safety and Health Act (OSHA), 1970 and subsequent revisions.
- Title 29, Code of Federal Regulations, Pt. 1910, Sec. 107. Occupational Safety and Health Standards. Spray Finishing Using Flammable and Combustible Materials.
- Sec. 178. Powered Industrial Trucks.
- Sec. 304. Wiring Design and Protection.
- Glenn Environmental Programs Manual.

NASA Responsible Official: [Manuel Dominguez](#)

Web Curator: [Deborah Ripley](#)